Claims

What is claimed is:

1. An injectable bone-like implant capable of increasing its porosity *in situ* comprising at least one bone-like compound and a hydrophobic carrier.

2. The injectable bone-like implant according to claim 1, wherein said bone-like compound is capable of aqueous sintering or curing.

3. The injectable bone-like implant according to claim 1, wherein said at least one bone-like compound is tricalcium phosphate, dicalcium phosphate, or monocalcium phosphate, potassium phosphate, calcium sulphate, hydroxyapatite, bioactive glass or combinations thereof.

4. The injectable bone-like implant according to claim 1, wherein said bone-like implant further comprises at least one of osteogenic, vasogenic, neorogenic, or like growth factors, hormone, or protein.

5 The injectable bone-like implant according to claim 4, wherein said at least one osteogenic factor or protein is selected from the group consisting of platelet derived growth factors (PDGF), transforming growth factors (TGF-.beta.), insulin-like growth factors (IGF's), fibroblast growth factors (FGF's), epidermal growth factor (EGF), human endothelial cell growth factor (ECGF), granulocyte macrophage colony stimulating factor (GM-CSF), nerve growth factor (NGF), vascular endothelial growth factor (VEGF), cartilage derived morphogenetic protein (CDMP), bone morphogenetic proteins (BMP's), and combinations of the foregoing

6. The injectable bone-like implant according to claim 4, wherein one or more said osteogenic protein is selected from the group consisting of OP-1, OP-2, BMP2, BMP3, BMP4, BMP9, DPP, Vg-1, 60A, and Vgr-1, including naturally sourced and recombinant derivatives of the foregoing.

7. The injectable bone-like implant according to claim 1, wherein said bone-like implant further comprises demineralized bone matrix.

8. The injectable bone-like implant according to claim 1, wherein said hydrophobic carrier is squalene, hydrophobic proteins, lipids, amphophyllic proteins, glycoproteins, polyesters, polyanhydrides, polyamines, nylons, or combinations thereof.

9. The injectable bone-like implant according to claim 1, wherein said hydrophobic carrier comprises a wax-like low molecular weight biodegradable polymers selected from the group consisting of polyglycolic acid, a copolymer of polycprolactone and polyglycolic acid, or other polyesters, polyanhydrides, polyamines, nylons, or any combinations thereof.

10. The injectable bone-like implant according to claim 1, further comprising an aqueous component.

11. The injectable bone-like implant according to claim 10, wherein said aqueous component is water, saline, blood, or the like, or any combination thereof.

12. A method of producing an injectable bone-like implant, wherein said implant is capable of increasing its porosity *in situ*, said method comprising the steps of:

mixing at least one bone-like compound in a hydrophobic carrier; and

concurrently or subsequent to said mixing step, combining said at least one bone-like compound and said hydrophobic carrier with an aqueous phase to form a combined mixture.

13. The method according to claim 12, wherein said at least one bone-like compound is tricalcium phosphate, dicalcium phosphate, or monocalcium phosphate, potassium phosphate, calcium sulphate, hydroxyapatite, bioactive glass or combinations thereof.

14. The method according to claim 12, wherein said bone-like implant further comprises at least one of osteogenic, vasogenic, neorogenic, or like growth factors, hormone, or protein.

15 The method according to claim 14, wherein said at least one osteogenic factor or protein is selected from the group consisting of platelet derived growth factors (PDGF), transforming growth factors (TGF-.beta.), insulin-like growth factors (IGF's), fibroblast growth factors (FGF's), epidermal growth factor (EGF), human endothelial cell growth factor (ECGF), granulocyte macrophage colony stimulating factor (GM-CSF), nerve growth factor (NGF), vascular endothelial growth factor (VEGF), cartilage derived morphogenetic protein (CDMP), bone morphogenetic proteins (BMP's), and combinations of the foregoing.

16. The method according to claim 14, wherein one or more said osteogenic protein is selected from the group consisting of OP-1, OP-2, BMP2, BMP3, BMP4, BMP9, DPP, Vg-1, 60A, and Vgr-1, including naturally sourced and recombinant derivatives of the foregoing.

17. The method according to claim 12, wherein said method comprises adding demineralized bone matrix to said bone-like compound.

18. The method according to claim 12, wherein said hydrophobic carrier is squalene, hydrophobic proteins, lipids, amphophyllic proteins, glycoproteins, polyesters, polyanhydrides, polyamines, nylons, or combinations thereof.

19. The method according to claim 12, wherein said hydrophobic carrier comprises a wax-like low molecular weight biodegradable polymers selected from the group consisting of polyglycolic acid, a copolymer of polycprolactone and polyglycolic acid, or other polyesters, polyanhydrides, polyamines, nylons, or any combinations thereof.

20. The method according to claim 12, further comprises an aqueous component.

21. The method according to claim 20, wherein said aqueous component is water, saline, blood, or the like, or any combination thereof.

22. The method according to claim 12, wherein said step of mixing at least one bone-like compound in a hydrophobic carrier further comprises the step of:

providing said at least one bone-like compound in a dried powdered form, and reconstituting said dried bone-like compound with said hydrophobic carrier.

23. A method of repairing a bone defect and injury comprising the steps of:

mixing at least one bone-like compound in a hydrophobic carrier;

concurrently or subsequent to said mixing step, combining said at least one bone-like compound and said hydrophobic carrier with an aqueous phase to form a combined mixture; and

administering an amount of said combined mixture in a patient at a site of need; wherein said combined mixture sets up *in situ,* thereby leaving a porous bone-like implant at the site of need.

24. An injectable bone-like implant capable of increasing its porosity *in situ* comprising at least one bone-like compound and at least one degradable component.

25. The injectable bone-like implant according to claim 24, wherein said at least one bone-like compound is tricalcium phosphate, dicalcium phosphate, or monocalcium phosphate, potassium phosphate, calcium sulphate, hydroxyapatite, bioactive glass or combinations thereof.

26. The injectable bone-like implant according to claim 24, wherein said bone-like implant further comprises at least one of osteogenic, vasogenic, neorogenic, or like growth factors, hormone, or protein.

27. The injectable bone-like implant according to claim 26, wherein said at least one osteogenic factor or protein is selected from the group consisting of platelet derived growth factors (PDGF), transforming growth factors (TGF-.beta.), insulin-like growth factors (IGF's), fibroblast growth factors (FGF's), epidermal growth factor (EGF), human endothelial cell growth factor (ECGF), granulocyte macrophage colony stimulating factor (GM-CSF), nerve growth factor (NGF), vascular endothelial growth factor (VEGF), cartilage derived morphogenetic protein (CDMP), bone morphogenetic proteins (BMP's), and combinations of the foregoing.

28. The injectable bone-like implant according to claim 26, wherein one or more said osteogenic protein is selected from the group consisting of OP-1, OP-2, BMP2, BMP3, BMP4, BMP9, DPP, Vg-1, 60A, and Vgr-1, including naturally sourced and recombinant derivatives of the foregoing.

29. The injectable bone-like implant according to claim 24, wherein said bone-like implant further comprises demineralized bone matrix.

30. The injectable bone-like implant according to claim 24, wherein said at least one degradable component is gelatin, polyglycolic acid and other polyhydroxypolyesters, cross-linked albumin, collagen, proteins, polysaccharides, glycoproteins, or any combination thereof.

31. The injectable bone-like implant according to claim 24, wherein said at least one degradable component a degradable gas-producing compound and an effective amount of an acid.

32. The injectable bone-like implant according to claim 31, wherein said degradable gas-producing compound is sodium bicarbonate, calcium bicarbonate, or the like, or any combination thereof.

33. The injectable bone-like implant according to claim 31, wherein said acid is citric acid, formic acid, acetic phosphoric acids, or HCl.

34. The injectable bone like implant according to claim 31, wherein said degradable gas-producing component is hydrogen peroxide and peroxidase.

35. A method of producing an injectable bone-like implant, wherein said implant is capable of increasing its porosity *in situ*, said method comprising the steps of:

mixing at least one bone-like compound in a degradable component; and

concurrently or subsequent to said mixing step, combining said at least one bone-like compound and said degradable component with an aqueous phase to form a combined mixture.

36. The method according to claim 35, wherein said at least one bone-like compound is tricalcium phosphate, dicalcium phosphate, or monocalcium phosphate, potassium phosphate, calcium sulphate, hydroxyapatite, bioactive glass or combinations thereof.

37. The method according to claim 35 wherein said bone-like implant further comprises at least one of osteogenic, vasogenic, neorogenic, or like growth factors, hormone, or protein.

38. The method according to claim 37, wherein said at least one osteogenic factor or protein is selected from the group consisting of platelet derived growth factors (PDGF), transforming growth factors (TGF-.beta.), insulin-like growth factors (IGF's), fibroblast growth factors (FGF's), epidermal growth factor (EGF), human endothelial cell growth factor (ECGF), granulocyte macrophage colony stimulating factor (GM-CSF), nerve growth factor (NGF), vascular endothelial growth factor (VEGF), cartilage derived morphogenetic protein (CDMP), bone morphogenetic proteins (BMP's), and combinations of the foregoing.

39. The method according to claim 37, wherein one or more said osteogenic protein is selected from the group consisting of OP-1, OP-2, BMP2, BMP3, BMP4, BMP9, DPP, Vg-1, 60A, and Vgr-1, including naturally sourced and recombinant derivatives of the foregoing.

40. The method according to claim 35, wherein said method comprises adding demineralized bone matrix to said bone-like compound.

41. The method according to claim 35, wherein said at least one degradable component is gelatin, polyglycolic acid and other polyhydroxypolyesters, cross-linked albumin, collagen, proteins, polysaccharides, glycoproteins, or any combination thereof.

42. The method according to claim 35, further comprising an aqueous component.

43. The method according to claim 42, wherein said aqueous component is water, saline, blood, or the like, or any combination thereof.

44. The method according to claim 35, wherein said at least one degradable component comprises a degradable gas-producing compound and an effective amount of an acid.

45. The method according to claim 44, wherein said degradable gas-producing compound is sodium bicarbonate, calcium bicarbonate, or the like, or any combination thereof.

46. The method according to claim 44, wherein said acid is citric acid, formic acid, acetic phosphoric acids, or HCl.

47. The method according to claim 44, wherein said degradable gas-producing component is hydrogen peroxide and peroxidase.

48. A method of repairing a bone defect and injury comprising the steps of:

mixing at least one bone-like compound with at least one degradable component;

combining said at least one bone-like compound and at least one degradable substance with an aqueous phase to form a combined mixture; and

administering an amount of said combined mixture in a patient at a site of need; wherein said combined mixture sets up *in situ*, thereby leaving a porous bone-like implant at the site of need.

49. The method according to claim 48, wherein said at least one bone-like compound is tricalcium phosphate, dicalcium phosphate, or monocalcium phosphate, potassium phosphate, calcium sulphate, hydroxyapatite, bioactive glass or combinations thereof.

50. The method according to claim 48, wherein said bone-like implant further comprises at least one of osteogenic, vasogenic, neorogenic, or like growth factors, hormone, or protein.

51. The method according to claim 50, wherein said at least one osteogenic factor or protein is selected from the group consisting of platelet derived growth factors (PDGF), transforming growth factors (TGF-.beta.), insulin-like growth factors (IGF's), fibroblast

growth factors (FGF's), epidermal growth factor (EGF), human endothelial cell growth factor (ECGF), granulocyte macrophage colony stimulating factor (GM-CSF), nerve growth factor (NGF), vascular endothelial growth factor (VEGF), cartilage derived morphogenetic protein (CDMP), bone morphogenetic proteins (BMP's), and combinations of the foregoing.

52. The method according to claim 50, wherein one or more said osteogenic protein is selected from the group consisting of OP-1, OP-2, BMP2, BMP3, BMP4, BMP9, DPP, Vg-1, 60A, and Vgr-1, including naturally sourced and recombinant derivatives of the foregoing.

53. The method according to claim 48, wherein said method comprises adding demineralized bone matrix to said bone-like compound.

54. The method according to claim 48, wherein said aqueous component is water, saline, blood, or the like, or any combination thereof.

55. The method according to claim 48, wherein said at least one degradable component comprises a degradable gas-producing compound and an effective amount of an acid.

56. The method according to claim 55, wherein said degradable gas-producing compound is sodium bicarbonate, calcium bicarbonate, or the like, or any combination thereof.

57. The method according to claim 55, wherein said acid is citric acid, formic acid, acetic phosphoric acids, or HCl.

58. The method according to claims 55, wherein said degradable gas-producing component is hydrogen peroxide and peroxidase.